

FREQUENCY BAND SHARING AMONGST CELLS

FIELD

[0001] The invention relates to the field of wireless communication systems and, particularly spectrum sharing in such systems.

BACKGROUND

[0002] Spectrum sharing is a common feature on unlicensed frequency bands where two different wireless networks may occupy the same frequency band without any regulation. With respect to licensed frequency bands, each operator has conventionally been assigned with a dedicated frequency band. From the point of view of efficient spectrum utilization, sharing spectrum on licensed frequency bands may be advantageous.

BRIEF DESCRIPTION

[0003] The invention is defined by the independent claims.

[0004] Embodiments of the invention are defined in the dependent claims.

LIST OF DRAWINGS

[0005] Embodiments of the present invention are described below, by way of example only, with reference to the accompanying drawings, in which

[0006] FIG. 1 illustrates a wireless communication scenario to which embodiments of the invention may be applied;

[0007] FIGS. 2 and 3 illustrate flow diagrams of embodiments for carrying out dynamic resource allocation of secondary frequency resources;

[0008] FIG. 4 illustrates a time-frequency diagram of resource allocation on a main frequency band and on a secondary frequency band;

[0009] FIGS. 5 to 7 illustrate signalling diagrams of embodiments for realizing the dynamic resource allocation between small area cell base stations and a large area cell base station;

[0010] FIG. 8 illustrates a flow diagram of a process for selecting a resource allocation scheme for a small area cell base station; and

[0011] FIGS. 9 and 10 illustrate block diagrams of structures of apparatuses according to some embodiments of the invention.

DESCRIPTION OF EMBODIMENTS

[0012] The following embodiments are exemplary. Although the specification may refer to “an”, “one”, or “some” embodiment(s) in several locations, this does not necessarily mean that each such reference is to the same embodiment(s), or that the feature only applies to a single embodiment. Single features of different embodiments may also be combined to provide other embodiments. Furthermore, words “comprising” and “including” should be understood as not limiting the described embodiments to consist of only those features that have been mentioned and such embodiments may contain also features/structures that have not been specifically mentioned.

[0013] FIG. 1 illustrates a wireless communication scenario to which embodiments of the invention may be

applied. Referring to FIG. 1, cellular communication networks of different operators have typically overlapping coverage areas. Base stations of different operators are illustrated in FIG. 1 with different filling patterns. For example, base stations **100**, **102** marked with dots represent base stations of a cellular communication system operated by a first operator, base stations **110**, **112**, **116** marked with vertical lining represent base stations of a cellular communication system operated by a second operator, and base stations **120**, **124** marked with horizontal lining represent base stations of a cellular communication system operated by a third operator. The cellular communication systems may operate according to specifications of the 3rd Generation Partnership Project (3GPP) Long-Term Evolution (LTE) Advanced or its evolution version having cognitive radio (CR) aspects. The cellular communication systems may support co-primary spectrum sharing as a flexible spectrum management and dynamic access scheme with cognitive radio technology. The co-primary spectrum sharing refers to a spectrum access model where two or more primary license holders (e.g. the network operators providing similar radio services) agree on joint use of at least a portion of their licensed spectrum. The exact usage conditions (policies) may be laid down in a mutual agreement, and the entire model may be subject to permission by a national regulator. The regulator may allocate a part of spectrum not exclusively to a single operator but jointly to several potential users (operators) with the obligation to use it collectively under fair conditions and subject to certain rules. The co-primary spectrum sharing will provide more dynamic spectrum sharing between operators providing the same/similar radio services.

[0014] The co-primary spectrum sharing together with cognitive radio access procedures may enable higher peak data rates for end users as well as higher capacity in the cellular communication systems, a natural result of increased bandwidth. Such shared spectrum usage seems especially beneficial and appropriate for small area cell deployments because these are usually more isolated than large area cells such as macro cells. The small cells may refer to micro cells, pico cells, and/or femto cells or other types of cells configured to provide radio coverage on a very small area (e.g. a hotspot) compared with the coverage area of macro cell which may span over several square miles. The local area deployments among different operator networks are very much location-dependent. It may not be most favorable to have static spectrum allocation policies among different operators, which is often applied commonly over the whole network area.

[0015] In FIG. 1, there are illustrated two large area cell base stations **116**, **124** and a plurality of small area cell base stations **100**, **102**, **110**, **112**, **120** located within a coverage or service area of a large area cell base station **116**. One small area cell base station **100** may be located within a service area of both large area cell base stations **116**, **124**. In reality, the number of base stations may be higher and a plurality of large area cell base stations may surround the base stations depicted in FIG. 1, and the embodiments of the invention are applicable to such other scenarios as well. However, let us concentrate on the scenario of FIG. 1 for the sake of simplicity.

[0016] Embodiments of the invention may be applied to a situation where co-primary spectrum sharing of secondary carrier(s) is used for high-density small area cells of different